

Evaluation of an optimized antenna cable for e-Callisto

Christian A. Monstein

ETH Zurich, Institute of Astronomy, CH-8092 Zurich, Switzerland

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Abstract. Several rather time consuming attempts were made to find the best solution concerning rf-cable shielding. At the end, an ideal combination of cable and connector was found and selected to supply all existing Callisto spectrometers and also all planned e-Callisto spectrometers.

Key words. Shielding, rfi, rf-connector.

1. Introduction

One of the 'l' within the word Callisto respective e-Callisto stands for 'low cost' thus, we bought the cheapest available connectors for the inter-connection between tuner and rear panel of the instrument without taking into account the specifications seriously enough. After checking the internal noise and birdies we found out that we got a tremendous internal noise level and hundreds of self produced birdies. A systematic analysis soon showed that the angle connector is the most critical point in the whole system. A few millimeter of unshielded coaxial cable are sufficient to let in rfi signals from quartz oscillators, RISC processor and attached digital circuits. Thus, one definitely should not ignore EMC aspects.

Different acronyms used in labels and text are described in table 1.

Send offprint requests to: Christian Monstein, e-mail: monstein@astro.phys.ethz.ch

Abbreviation	description
Birdy	Self produced spectral lines
Callisto	Low cost spectrometer
Conrad	Local component supplier
e-Callisto	Latest version of Callisto
EMC	Electromagnetic compatibility
ETH	Eidgenössisch Technische Hochschule
Pusterla	Local component supplier
rf	Radio frequency
rfi	Radio frequency interference
RG-58	Coaxial cable type 5mm
RISC	Processor with reduced instruction set

Table 1. Acronyms mentioned in labels and comments.



Fig. 1. From top to bottom: - Termination 50Ω as reference, - ideal cable RG-58 (black) with shielded connector from Conrad (metal), - commercial cable 75Ω (white) with unknown angle connector (white), - RG-58 (black) with low cost angle connector from Pusterla (white).

2. Measurements and Results

First the tuner was terminated with a 50Ω resistor. The spectrum was then stored as reference signal $Ref(\nu)$. Then the tuner was connected to the rear SMA connector by one of the three coaxial cables, see figure 1. For every cable $c = 1...3$ the relative spectrum was determined by

$$y_c(\nu) = \frac{Sig_c(\nu) - Ref(\nu)}{Ref(\nu)} \quad (1)$$

where c denotes to one of three coaxial cables and (ν) to the measured frequency. For plots, see figures 2, 3 and 4. There is just one combination which shows acceptable results that is to say cable RG-58 with shielded connector from Conrad. The other two cables have insufficient shielding and are thus not useable as rf connection in the spectrometer.

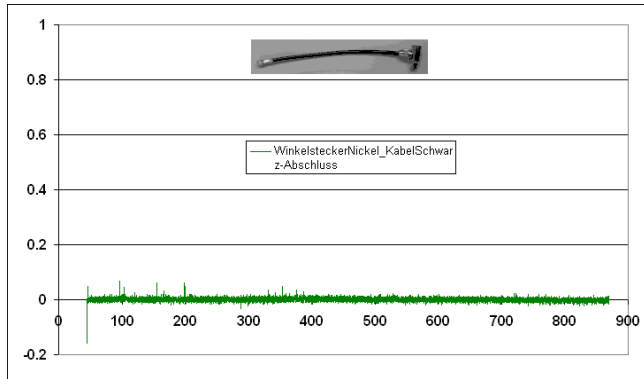


Fig. 2. Complete spectrum of e-Callisto using cable RG-58 (black) with shielded connector (metal) procured from Conrad. X-axis shows frequency in MHz, y-axis $(Sig - Ref)/Ref$, where $Ref = 50\Omega$. \rightarrow perfect.

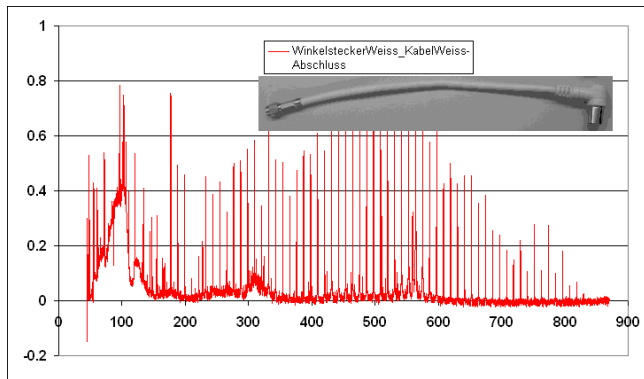


Fig. 3. Complete spectrum of e-Callisto using commercial cable 75Ω (white) with unknown angle connector (white) procured from Pusterla. X-axis shows frequency in MHz, y-axis $(Sig - Ref)/Ref$, where $Ref = 50\Omega$ \rightarrow catastrophic.

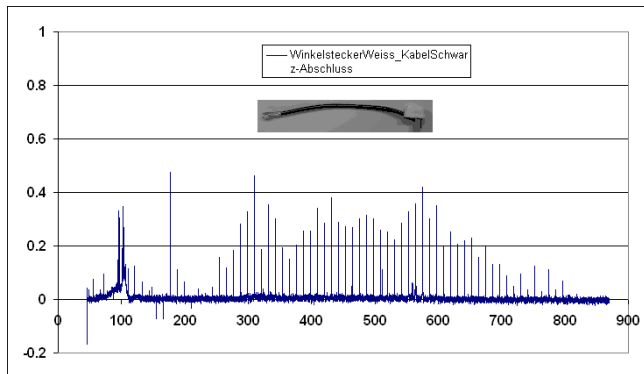


Fig. 4. Complete spectrum of e-Callisto using RG-58 (black) with low cost angle connector (white) also from Pusterla. X-axis shows frequency in MHz, y-axis $(Sig - Ref)/Ref$, where $Ref = 50\Omega$ \rightarrow really bad.

3. Conclusions

As already mentioned within the introduction one should take care of the component specification as well as of the EMC aspects especially in instruments with both analog - and digital electronics. At the end the best cable was just about 2 Swiss Francs more expensive than the other ones.

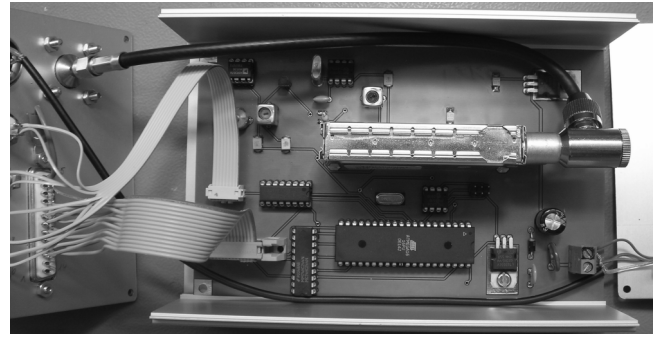


Fig. 5. E-Callisto unit with best selected cable installed between rear connector (SMA) and TV-tuner (IEC).



Fig. 6. The winner of the competition, Conrad coax connector 287490 - 62 for 3,95\$.

Finally the angle coax connector 287490 - 62, procured from Conrad, is the best for this kind of instrument.

4. Relevant internet addresses

4.1. Conrad

<http://www.conrad.com/>

4.2. Pusterla

http://www.pusterla.ch/htdocs/main_text.htm

4.3. RG-58

http://www.rfcafe.com/references/electrical/coax_chart.htm